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(54) Title of the Invention: Method for Dyeing Hydrous Contact Lens

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(54) TITLE OF THE INVENTION
Method for Dyeing Hydrous Contact Lens

(57) SUMMARY
[Purpose]
To provide a method whereby multi-colored dyeing of a hydrous contact lens can easily be carried out, without damaging the lens and without the use of a mold or pad and which enables flow like that of sheets, making product control more effective.
[Composition]
When desired symbols, graphics or lettering are printed by dyeing onto the desired position of a hydrous contact lens, a dyeing solution is applied to the surface of said contact lens in a dry state by means of an inkjet device.

SCOPE OF THE INVENTION

CLAIMS
1. A dyeing method for a hydrous contact lens which is characterized whereby when desired symbols, graphics or lettering are printed by dyeing onto the desired place of a hydrous contact lens, a dyeing solution is applied to the surface of said contact lens in a dry state by means of an inkjet device.

2. The dyeing method for a hydrous contact lens cited in Claim No. 1 which is characterized whereby when the dyeing solution is applied, water is sprayed either before or at the same time as said application onto the desired portion of the lens from a separate, minute nozzle placed on the inkjet device.

DETAILED DESCRIPTION OF THE INVENTION
Field of Industrial Application

0001 The present invention relates to a dyeing method for a hydrous contact lens, in particular to a method whereby dyeing can be carried out in the desired form onto the desired position of the lens.

Prior Art
0002 Placement of lettering or symbols on the desired portion of a contact lens is an effective means for detecting the front from the reverse side of the lens; the right from the left lens or the lens specification marking when a hydrous contact lens absorbs water and becomes soft.
0003 Conventional methods used to mark a contact lens with symbols or lettering include: (1) The marking method disclosed in Japanese Patent Publication No. 2692 of 1978, whereby a printing device was used to form an indented portion on the surface of the contact lens; (2) The marking method disclosed in Japanese Patent Publication No. 39140 of 1979, whereby a coupling ingredient was pre-added to the polymer that formed the lens and then the contact lens material underwent chromogenic processing due to the reaction that takes place when exposed to diazonium salt; (3) The marking method disclosed in Japanese Patent Publication No. 10045 of 1989 whereby exposure of a photographic development plate was used for

marking the contact lens; (4) The marking method disclosed in Japanese Patent Publication No. 270312 of 1992, whereby a monomer unit of the polymer frame that constitutes the lens was covalent-bonded and the reactive dyeing agents that bonded either coated or permeated the surface of the lens, alkaline processing was performed and sectional print-dyeing was adhered to the surface; (5) The marking method disclosed in Japanese Patent Publication No. 45253 of 1978 which utilizes a printing pad as a means for marking the lens.

Problems to be solved by the invention

0004 However, for the aforementioned method no. 1, in order to form the indented portion on the contact lens, it was inevitable that the mechanical strength of the contact lens would deteriorate, making it easier to tear. In addition, for aforementioned method no. 2, there was the disadvantage that the lens would change color or fade after prolonged use. For aforementioned method no. 3, there was a disadvantage in that it was necessary to use an ultraviolet ray to perform the exposure, and the dyes that could be used were limited to pad dyes.

0005 In addition, for the aforementioned method no. 4, although the dye adhered well, it required the use of a screen to form the shape of the desired lettering or symbols and since it was necessary to layer the screen on top of the lens so that it would come into contact with the desired portion on the lens, it was a cumbersome task.

0006 For the aforementioned method no. 5, the task was easy to perform but when detailed lettering or symbols were imprinted, the ink would smear, causing the lettering to blur easily.

0007 In the aforementioned methods no. 2 through 5, since a screen or pad was necessary to form the desired lettering or symbols, it became very tedious to mark the product number on each individual lens in order to perform product control.

0008 The present invention is intended to provide a means to counteract the problems pertaining to the conventional technology and the main objective is to provide a dyeing method for a hydrous contact lens whereby an inkjet device is used on the desired portion of the contact lens to dye it by applying a dyeing solution and print-adhering it to the lens in the form of desired lettering or symbols.

Means for solving the problems of the invention

0009 In other words, the dyeing method for the hydrous contact lens in the present invention, is characterized whereby when desired symbols, graphics or lettering are printed by dyeing onto the desired place of said hydrous contact lens, a dyeing solution is applied to the surface of said lens in a dry state by means of an inkjet device.

0010 Furthermore, said method is characterized in that when the dyeing solution is applied, water is sprayed either before or at the same time as said application onto the desired portion of the lens from a separate, minute nozzle placed on the inkjet device.

0011 Hereunder, the present invention will be described in detail.

0012 For the dyeing operation used in the method for the present invention, an inkjet device is used to apply a dyeing solution to the surface of the contact lens and then a commonly used adhering process is performed. After this, a graphic pattern consisting of letters, graphics or symbols can be drawn on the surface of the lens by the electronic control of an inkjet device. It becomes easy to draw a different pattern on each individual lens via on-line operation.

0013 A commonly used inkjet device can be utilized for the inkjet device for the present invention. In addition, by using an inkjet device equipped with a multi-color dye reservoir and multiple minute nozzles to spray the dyeing solution, it is possible to perform multi-color dyeing. The main components of the subject hydrous contact lens for the present invention are monomers of 2-hydroxy ethyl methacrylate; 2,3-dihydroxy propyl methacrylate, N-vinyl pyrodone; glycerol methacrylate; N; N-dimethyl acrylic amido, etc. Copolymers then form from the copolymerization of the aforementioned monomers to comprise the contact lens for the present invention.

0014 For the present invention, the dyeing process is performed on a hydrous contact lens in a dry state. When a non-hydrous copolymer is used to shape the lens for the hydrous contact lens in a dry state, reference is being made to the shape in which the contact lens itself is formed; however, when a contact lens is formed by swelling, reference is being made to its dry state prior to the dyeing operation.

0015 For the dyeing operation in the present invention, when the dyeing solution is applied, a small amount of water is sprayed either before or at the same time as said application from a minute nozzle that is equipped separately on the inkjet device into the desired lettering or graphics, etc. onto the dry lens, causing it to swell in sections. The present operation is performed for the purpose of facilitating the dyeing solution that is applied to the surface of the lens to permeate into the inner portion of the lens.

0016 Moreover, the dyeing solution used in the present invention is comprised mainly of a dyeing agent in addition to a surface-reactive agent. When necessary, a dyeing auxiliary or a thickener may be added. Examples of commonly used dyeing agents for contact lens include vat dyes or reactive dyes. Examples of vat dyes include C.I. Vat Blue 6, C.I. Vat Green 1, or an indigo blue such as C.1. Vat Blue 1, or C. I. Vat Black 1. In addition, examples of reactive dyes are C. I. Reactive Blue 19, C. I. Reactive Blue 27, C. I. Reactive Blue 28, C. I. Reactive Violet 5, C. I. Reactive Black 5 or C. I. Reactive Black 14.

0017 The concentration of dye used differs according to the type of dye used and the intended application, however, a desirable concentration is 0.01~20.0%. An even more desirable concentration is 0.05~15.0%. If the concentration of dye is too low, the resulting color is too light and the purpose of marking the lens is defeated. On the other hand, if the concentration is too high, the color is too dark and can be detected by others, which is not very favorable from an aesthetic standpoint.

0018 The surface-reactive agent works effectively to suppress the blotting that tends to occur when a hydrous contact lens is marked. If a water-soluble dyeing agent is used to mark the hydrous contact lens, the dyeing agent disperses beyond the marked portion. This causes blotting, which in turn inhibits a clear coloring. However, by adding an appropriate amount of surface-reactive agent to the dyeing agent, blotting does not occur and a clear coloring can be achieved.

0019 For the surface-reactive agent, a hydrogen oxide series, silicone series or a fluoride series can be used.

0020 The amount of surface-reactive agent to be added will vary according to the type, etc., but a desirable amount is 0.001~5.0%. An even more desirable amount is 0.01~2.0%. If not enough of the surface-reactive agent is added, the effects of the agent will deteriorate and blotting will become more likely. On the other hand, it is not favorable to add more than is necessary because the surface-reactive agent will not become more effective.

0021 The dyeing agent is used to help the dye permeate into the lens or to help the dye

adhere more effectively. Examples of dyeing agents that are commonly used are sodium sulfate or sodium chloride. The use of such dyeing agents allows for easier and more uniform dyeing.

0022 The use of thickener controls the amount of dyeing solution that is sprayed from the inkjet device onto the surface of the lens. Examples of thickeners are sodium alginic acid, starch, carboxyl methyl cellulose, polyvinyl pyrodone, sodium polyacrylic acid, glycerin, or polyethylene glycol.

Examples

0023 The present invention will be explained in further detail by the use of the following examples. However, the present invention in not limited to said examples.

0024 Example 1: 3.0g of C.I. Reactive Black 5 dye, 0.5g of sodium sulfuric anhydride, 0.2g of Fluorad FC-430 (fluoride surface-reactive agent manufactured by Sumitomo 3M Company) and 1g of glycerin were dissolved in 50cc of distilled water to make a dyeing solution. A hydrous contact lens material that was 38% water content and comprised mainly of 2-hydroxy ethyl methacrylate was used and processed to achieve a hydrous contact lens in a dry state and then was affixed to a lens-affixing jig.

0025 Next, an ink reservoir that had been filled separately with the aforementioned dyeing solution, water and 1% NaOH solution and an inkjet device equipped with a minute nozzle for spraying were used to draw the desired lettering or graphics onto the contact lens with water, dyeing solution and an alkaline solution, in that order, and the lens was left untouched for 3 minutes at room temperature. The lens was then saturated in a 0.5% NaOH solution for approximately 20 minutes, allowing it to swell with water, was removed from the solution, rinsed off and boiled for 30 minutes in normal saline.

0026 Clear black lettering or graphics were print-dyed onto the soft contact lens. An example of the specifications for the finished product is shown in Figure 1.

0027 Next, the soft contact lens that had already been marked was tested using the testing methods explained below to confirm its dyeing properties.

0028 (1) Light resistance test: the marked lens and 0.9% normal saline were put into a 20cc clear glass vial and let stand outdoors for 30 days.

0029 (2) Boil resistance test: the marked lens and 0.9% normal saline were put into a 20cc clear glass vial and let stand in a 100°C air thermostat for a maximum of 150 hours.

0030 For each method, in order to conduct a comparison, the lens was visually examined before the processing was performed.

0031 As a result, abnormalities such as fading, discoloration or bleeding of the lettering were not observed for either of the lenses.

0032 Example 2: 2.0g of C.I. Reactive Green 6 dye, 0.5g of sodium sulfuric anhydride, 0.1g of NIKKOL NP-10 (a hydrocarbon series surface-reactive agent manufactured by Nikko Chemicals Company) and 1g of sodium alginic acid were dissolved into 30cc of distilled water to make dyeing solution A. And 2.0g of C.I. Reactive Blue 19 dye, 0.5g of sodium sulfuric anhydride, 0.2g of Fluorad FC-430 and 1g of polyvinyl pyrodone were dissolved into 30cc of distilled water to make dyeing solution B.

0033 Next, an ink reservoir that had been filled separately with the aforementioned dyeing solutions A and B, water and 1% NaOH solution and an inkjet device equipped with a minute nozzle for spraying were used to draw the desired graphic pattern onto the hydrous contact lens, which was in a dry state (a contact lens comprised of 2,3-dihydroxy propyl methacrylate

as the main component and with a 38.5% content of water) with water, dyeing solution and an alkaline solution, in that order, and the lens was left at room temperature for 5 minutes. The lens was then saturated in a 0.5%NaOH solution for approximately 20 minutes, was removed from the solution, rinsed off and boiled for 30 minutes in normal saline.

0034 The soft contact lens was print-dyed with clear blue or green lettering or graphics. The specifications of the finished product were like those shown in Figure 2.

0035 Example 3: 3.0g of C.I. Vat Blue 6 dye, 2.0g of sodium hydrosulfite, and 0.3g of sodium sulfuric anhydride were dissolved into 30cc of distilled water to make a dyeing solution. A hydrous contact lens which was a polymer mainly comprised of N, N-dimethyl acrylic amido and consisting of 60% water was used and processed to achieve a hydrous contact lens in a dry state and then was affixed to a lens-affixing jig.

0036 Next, an inkjet device filled with the aforementioned dyeing solution was used to draw the desired lettering or graphics onto the contact lens, and left at room temperature for 3 minutes. The lens was then saturated in a 0.5% NaOH solution for approximately 20 minutes, allowing it to swell with water, was removed from the solution, rinsed off and boiled for 30 minutes in normal saline.

0037 The soft contact lens was print-dyed with clear blue lettering or graphics. The specifications of the finished product were like those shown in Figure 3.

0038 Example 4: 8.0g of C.I. Reactive Black 5 dye, 0.1g of sodium sulfuric anhydride and 0.1g of Fluorad FC-430 (fluoride surface-reactive agent manufactured by Sumitomo 3M Company) were dissolved in 50cc of distilled water to make a dyeing solution. A hydrous contact lens polymer that was 38% water content and comprised mainly of 2-hydroxy ethyl methacrylate was used and processed to achieve a hydrous contact lens in a dry state and then was affixed to a lens-affixing jig.

0039 Next, an ink reservoir that had been filled separately with the aforementioned dyeing solution, water and 1% NaOH solution and an inkjet device equipped with a minute nozzle for spraying were used to draw the desired lettering or graphics onto the contact lens with water, dyeing solution and an alkaline solution, in that order, and the lens was left at room temperature for 3 minutes. The lens was then saturated in a 0.5% NaOH solution for approximately 20 minutes, allowing it to swell with water, was removed from the solution, rinsed off and boiled for 30 minutes in normal saline.

0040 The soft contact lens was print-dyed with clear black lettering or graphics.

The effects of the invention

0041 If one conforms to the present invention, it will not be necessary to use a pad or screen to form the desired lettering or graphics in advance and it is much easier to set the lettering or graphics in the desired position. In addition, since this operation is not a printing method, there is very minimal risk of damaging the lens. Also, multi-colored dyeing, which was a very difficult operation in conventional methods, becomes much easier to perform.

0042 Moreover, the present invention allows for marking of each individual soft contact lens in order to identify them with specifications or product numbers. The end result is an operation that enables flow like that of sheets, making product control more effective.

Brief description of the diagrams

Figure 1: A plan view of the soft contact lens manufactured according to the method for Example No. 1 of the present invention.

Figure 2: A plan view of the soft contact lens manufactured according to the method for Example No. 2 of the present invention.

Figure 3: A plan view of the soft contact lens manufactured according to the method for Example No. 3 of the present invention.

Figure 1	Figure 2	Figure 3
[image]	[image]	[image]

L1 ANSWER 1 OF 4 WPIDS COPYRIGHT 2000 DERWENT INFORMATION LTD
ACCESSION NUMBER: 1996-271835 [28] WPIDS
DOC. NO. NON-CPI: N1996-228499
DOC. NO. CPI: C1996-086333
TITLE: Colour marking water-absorbing ***contact*** ***lens*** for multicolour lens - by ***ink*** - ***jet*** printing dye soln. onto surface of dried ***contact*** ***lens*** , useful for direct colour mark printing avoiding screens or stamp pads.
DERWENT CLASS: A14 A35 A96 D22 P42 P81
PATENT ASSIGNEE(S): (SHIH) SEIKO EPSON CORP
COUNTRY COUNT: 1
PATENT INFORMATION:

PATENT NO	KIND	DATE	WEEK	LA	PG
JP 08112566	A	19960507	(199628)*		5

APPLICATION DETAILS:

PATENT NO	KIND	APPLICATION	DATE
JP 08112566	A	JP 1994-307986	19941212

PRIORITY APPLN. INFO: JP 1994-202357 19940826
AB JP 08112566 A UPAB: 19960719
Letters, patterns, or symbols are dyed at a desired part of the water-absorbing ***contact*** ***lens*** by coating a dye soln. with an ***ink*** - ***jet*** appts. on the surface of the ***contact*** ***lens*** which is dried.
USE - For marking colour marks on water-absorbing ***contact*** ***lenses*** .
ADVANTAGE - Colour marks can be printed directly without screens or stamp pads. At least two colours can be used.
Dwg.0/0

L1 ANSWER 2 OF 4 WPIDS COPYRIGHT 2000 DERWENT INFORMATION LTD
ACCESSION NUMBER: 1992-142903 [18] WPIDS
DOC. NO. NON-CPI: N1992-106937
DOC. NO. CPI: C1992-066322
TITLE: Liq. absorbent compsn. - forming semi-inter-penetrating polymer network providing durable ink-absorbing layer.
DERWENT CLASS: A26 A82 A96 A97 D22 G05 P73 P75 T04
INVENTOR(S): IGBAL, M; STOFKO, J J; IQBAL, M
PATENT ASSIGNEE(S): (MINN) MINNESOTA MINING &; (MINN) MINNESOTA MINING & MFG CO
COUNTRY COUNT: 8
PATENT INFORMATION:

PATENT NO	KIND	DATE	WEEK	LA	PG
EP 482837	A	19920429	(199218)*	EN	15
R: CH DE FR GB IT LI					
JP 04288367	A	19921013	(199247)		11
US 5219928	A	19930615	(199325)		11